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System Monitoring of the Emotional State of Students in High School

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Abstract: The resistance of skin is measured by means of special elastic bracelet which is connected to fingers and then is transmitted to measuring device. The control is based on the method of measurement impedance of students. After this, the detected signal from output of the measuring device is sent to PC. Special software treats this information and diagnoses the students. This system is basically able to: to determine the emotional status of students; to create daily archive database for each student; to make analysis accordingly to this archive.

Keywords: Correction, Signal, Impedance, Controlling System, Emotional State

1. Introduction

The efficiency of automated controlling system depends primarily upon the algorithm used for diagnostics. Optimally developed algorithms for these systems are able to effectively discriminate different pathologies as well as to evaluate the situation in general checking of students. The security of objects to be controlled depends subjectively upon the emotional status of students. By this reason, it's worthwhile to make some conclusions about the correlation between the physiological parameters measuring and the officer behavior. The skin impedance can serve as one of these parameters.

It's taken that the impedance of body's tissue to be controlled is characterized not only by active resistance but the capacity resistance also. As it's known, the impedance of studied body's tissue depends strictly upon the physiological status of the body. Generally, the measurement is realized by the bridge method which sufficiently reduces the sensitivity. It was determined that offender's evidences have been followed by nervous tension which leads to various physiological phenomena like arising the blood pressure, increasing the skin resistance and so on [1, 2]. In ordinary conditions the skin resistance is estimated to be to 3÷100kΩ, but during excitement this value changes of about 5%. Register is connected to output of the measuring system. Information is personally treated by medical staff with mentioned devices and thus, the subjectivity and/or technical errors can be made while the process.

2. Problem Statement

Human organism is consisted of biological fluids containing a lot of ions which participate in various exchange processes. Under the electrical field ions move with various velocities and are clustered near the cell membranes forming oncoming polarization electrical fields. So, the initial action of direct current is connected with a motion of ions, with their separation and changing their concentration in various elements of tissues.

Biological tissues and organs are the rather heterogeneous formations with various electrical resistances which can change under the action of electrical current. This makes a complexity of electrical resistance measurements of alive biological systems. This method is more preferable than the control method by measurement blood pressure because it is an express method, more sensible and, at last, measuring impedance via a bridge circuit the devices posses more high precision than ones measuring blood pressure. And measuring impedance devices are no inertial (table 1).

The electroconductivity of some sites of organism is

appreciably depended on the resistances of a skin and hypodermic layers. Inside of organism, mainly, the current spreads on the blood and lymphatic vessels, muscles and nerve sheaths. And the resistance of skin is defined by its condition: a thickness, an age, a humidity etc. Also, the electroconductivity of tissue and organs is depended on the functional state and therefore can be used as diagnostic indicator [3-5].

Table 1. *Comparison two methods of measurements.*

#	Measuring precision of device	Rate of measurement
1. Measurement of blood pressure	(5 - 10)%	Inertial
2. Measurement of impedance	(0, 05 - 0, 8)%	Noninertial

The proposed automated control system functions by the next way: a) the skin impedance is taken as the diagnostic information; b) elastic bracelet attached to fingers detects the skin resistance and transmits it to device which measures emotional status [6].

The skin impedance change is respectively magnified in device which has to detect the emotional status and then this change is put into accordance with the voltage. After that the signal is transmitted to USB port of PC. The obtained information is treated using special software, and then controlling officer diagnoses the situation. The involved person skin impedance value obtained from the diagnosis is compared with archived value of the impedance. Any conclusion is made accordingly to the difference between the current impedance and the average from archived ones. This difference in percentage, the proposed number of procedures as well as the effect time is a priori ordered by physiotherapy specialist and is introduced into the algorithm to be developed. In dependence on the diagnosis results, suggestions for applying (or not applying) the electrostimulation or the electrosleep are made.

The specific resistances of various tissues and fluid of organism are presented in table 2.

Table 2. *The specific resistances of various tissues and fluid of organism.*

#	Organ	Specific resistances, Ohmxcm
1	Cerebrospinal fluid	0, 55
2	Blood	1, 66
3	Muscles	2
4	Brain and neural tissue	14, 3
5	Adipose tissue	33, 3
6	Dry skin	10^5
7	Bone without periosteum	10^7

Electrostimulation is the method based on using impulsive currents to restore the functions of nervous-muscular system. Electrosleep is that for affecting on the central nervous system by direct impulsive current of low frequency, or low intensity. For treatment by electrosleep the apparatus generates impulses of the direct current of frequency 100 Hz. Electrosleep is harmless and gives good results in treatment of neurosis, asthenic states and schizophrenia.

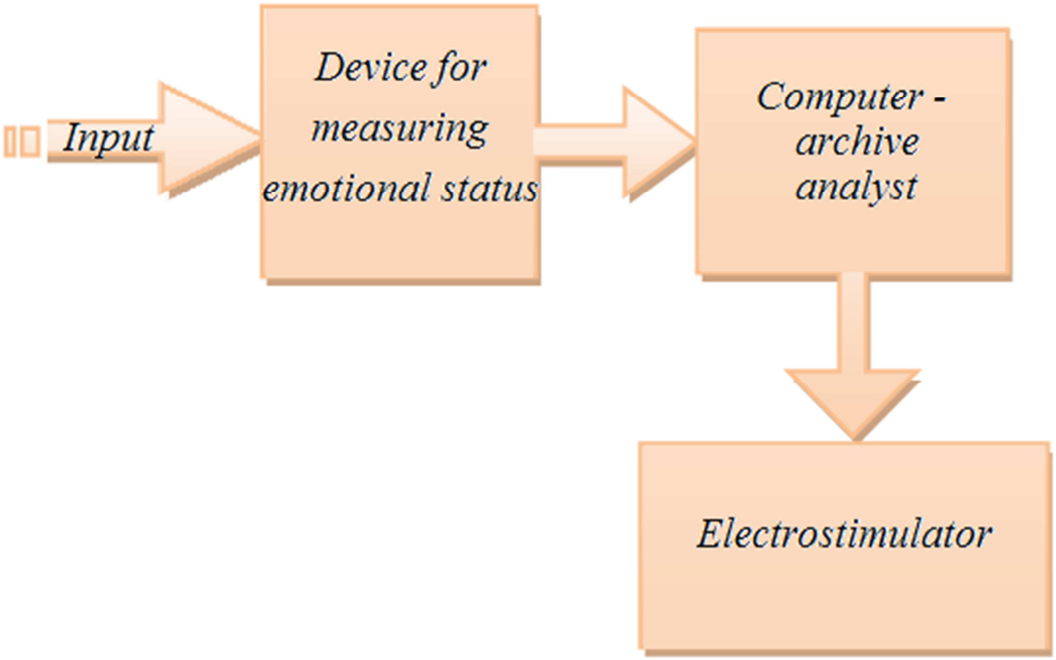

Figure 1. *The logical scheme of the system.*

In dependence on diagnosis results, if the impedance average value runs forward and back of the normal value, the system automatically connects the stimulator (2) to the patient. Programming the diagnosis and the correction, introducing them into the automatic system as well as their applications increase the efficiency of restoring methods

and prevent from occasional errors of controlling student. This system basically allows to: a) determine the emotional status of students; b) create daily archive personal database for each staff; c) make checking by using this archive database.

Except this one, in determining the emotional status of involved person the system will wait for confirmation of physiotherapy specialist which realizes the checking to connect automatically the stimulation device. After that, the system makes additional measuring of the stimulated person. This procedure can be repeated a few times in order to bring the personal into its respective normal status. Measuring data in any case are archived.

Main components of automated system are control block of emotional state and correction block comprising nodes of electrical stimulation and electrical relaxation. The working principle of automated system:

- Analysis of the state of students using the emotional state control block.
- The results of analysis are sent in PC memory, shown on PC monitor, compared with information stored in Data Base for given student.
- When deviation from common level of psychic-emotional state subject to required working conditions at given moment PC outputs a command for electro stimulation or electro relaxation. At the same time, the emotional state control block analyses continuously state of student.
- Electro stimulation or electro relaxation continues up to while the emotional state of student will be in compliance with his common, base state.
- Average time of analysis and correction is about (5-8) min.
- If will be not possible normalize state of student, PC outputs an advice for more extensive medical survey student in stationary conditions.

Electrophoresis is moving suspended solid particles, gas babbles and colloidal particles in liquid under electric field.

That to get and to fix information about state and parameters of medical-biological system it is needed to has a facility set. The primary element of this set is a sensitivity element of measuring device called pickup element. This element contacts with medical-biological system, other elements usually are isolated from system, in some cases they are far from system.

In sets of medical electronics the sensitivity element generates an electric signal or changes one under the action of biological system. So, pick-off set transforms medical-biological and physiological information to signal of electronic set. Two sorts of pick-off sets are used in medical electronics: electrodes and sensors. Finite element of measuring chain is a measure which reflects or records information about biological system in form accessible for immediate perception by observer.

In many cases there are some elements between pick-off set and measuring set. These elements amplify initial signal and propagate away.

The control block of functional state measures a level of wakefulness and functional state of man by measurement of electrodermal resistance with two electrodes fixed on the ring and forefinger fingers on the one of arms. This block records and analyses the amplitude-time characteristics of phasic component of the electrical resistance of skin. The change of these characteristics reflects a level of wakefulness and functional slate and gives an indirect characteristic of efficiency variation of students or of some another personnel [7-9].

The organism tissues conduct both direct and alternating current. Biological cells possess capacitive properties, so the impedance of organism tissues is determined by ohm R and capacitive resistances:

$$Z = \sqrt{R^2 + (1/\omega C)^2} \quad (1)$$

Existence of capacitive elements in biological systems is confirmed by that a current leads applied voltage.

An impedance of organism tissues is defined by their physiological states. When filling of blood-vascular system the impedance changes subject to state of cardiovascular activity [10, 11].

The electrical circuit of device has a high sensitivity, allows registering even a weak nervousness of man and reacts to the slightest change of impedance [5, 12]. Automated system was developed for carrying out control and correction functional state of students in high school.

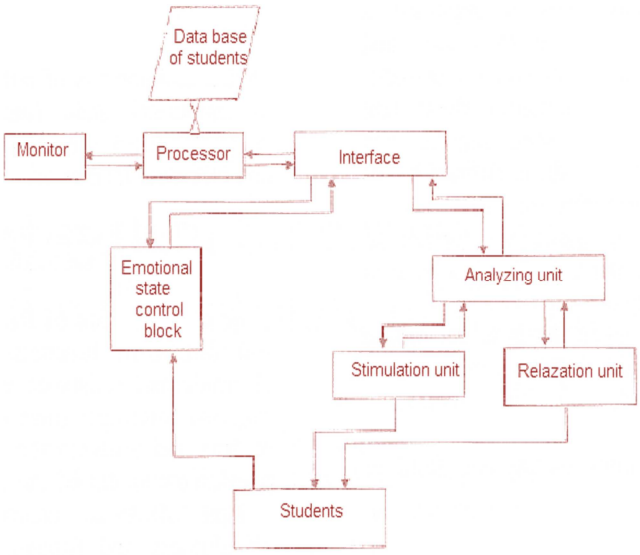

Figure 2. *The block diagram of automated system ofcontrol and correction of activities and functional state of flight dispatchers.*

The system includes:

PC with especial developed mathematical software

controlling devices; created base of psychic -emotional data of common state for each student; the PC-devices 4-chanel matching interface; the emotional state control block (impedance measurement); the mode of organism electro stimulation; the node of organism electro relaxation.

It should be noted that if results of the measuring are in

accordance with the patient's normal status, these results are archived in the system database; in contradictory the stimulation regime is automatically launched.

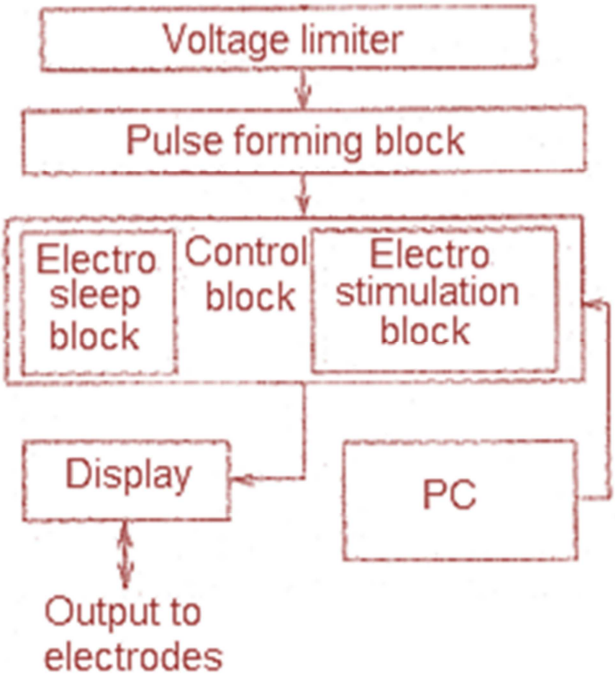

Figure 3. *Block diagram of electro stimulation.*

3. Conclusions

Some specifications of using this program are provided below:

Required information is included into the system database by physiotherapy specialist and it's proposed that some of this information will be used further for measuring the patient emotional status.

The menu of the working program is designed for checking the archive database for each patient to be selected for determining its emotional status. For this it's necessary to introduce the patient's name and/or its code into the menu. Another testing menu is designed to measuring the emotional status. In measuring process physiotherapy specialist can change first time the parameter which describes the emotional status of patient in special window which appears on the PC display. After that, the measuring process can be started by connecting electrodes to the patient's fingers and pressing starting button.

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